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## Sonic Textiles for Health and Wellbeing

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# The Design Journal

## Sonic Textiles for Health and Wellbeing

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<b>Abstract:</b>	<p><b>Acknowledgements:</b>  Lucy Robertson began her PhD at Duncan of Jordanstone College of Art &amp; Design (DJCAD) at the University of Dundee in January 2017, funded through a DJCAD Studentship. She is supervised by Dr Chris Lim and Professor Wendy Moncur. Dr Sara Robertson - who was integral to the conceptualisation, instigation and initial supervision of this PhD research - is now an Honorary Research Fellow at the University of Dundee.</p> <p>Sonic Textiles for health and wellbeing outlines a PhD study using textiles as an interface for sound applied within health and wellbeing.</p> <p>We use textiles for protecting our bodies, helping keep us warm or stay cool in different environments. They are sensory objects, that can engage our sight, touch, sense of smell and even our hearing. In the past textile designers have considered the sensual aspects of their designs, mainly focusing on the inherent visual and tactile qualities. Over the last few years the addition of sound to textiles within research and design can be seen in the work of Cathy Treadaway and Cute Circuit. Technology is easily integrated within textiles with components becoming smaller and more sophisticated. Sabine Seymour suggests that audio could become central to the success of smart clothes (Lipsky, 2014). This study will investigate adding to the natural qualities of textiles through the addition of sound creating sonic textiles.</p> <p>The purpose of this study is triple layered; (1) it looks to encourage and share the making of sensory and sonic textiles, (2) it investigates how making affects our identity while (3) gaining a better understanding of what affect sensory and sonic textiles can have on health and wellbeing.</p>

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## PhD Study Report: Sonic Textiles for health and wellbeing

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### Overview

Sonic Textiles for health and wellbeing outlines a PhD study using textiles as an interface for sound applied within health and wellbeing.

We use textiles for protecting our bodies, helping keep us warm or stay cool in different environments. They are sensory objects that can engage our sight, touch, sense of smell and even our hearing. In the past, textile designers have considered the sensual aspects of their designs, mainly focusing on the inherent visual and tactile qualities. Over the last few years the addition of sound to textiles within research and design can be seen in the work of Cathy Treadaway and Cute Circuit. Technology is easily integrated within textiles with components becoming smaller and more sophisticated. Sabine Seymour suggests that audio could become central to the success of smart clothes (Lipsky 2014). This study will investigate adding to the natural qualities of textiles through the addition of sound creating sonic textiles.

The purpose of this study is triple layered; (1) it looks to encourage and share the making of sensory and sonic textiles, (2) it investigates how making affects our identity while (3) gaining a better understanding of what affect sensory and sonic textiles can have on health and wellbeing.

### Introduction

Through the making of sonic textiles, research through practice will combine conductive material, sound design and aesthetics to make an auditory experience and inform textile designers how to enhance their work by adding sound. These sonic textiles will be tested to investigate the impact they can have on health and wellbeing within society.

Alongside the creation of sonic textiles, this PhD is looking to explore identity through making. What makes us who we are? For example, learning crochet from your Great Granny, making memories through photography or experimenting with cooking, people 'make' every day. A strand of this research will explore how 'making' forms an individual's sense of self.

### Smart Textiles for Health and Wellbeing

There are a number of designers and studios using smart textiles to push the boundaries of fashion and exploring the possibilities of technology within textile design. These explorations and applications have resulted in textile-related wearables such as Cute Circuit's LED garments that play with communication through textiles (Mayer 2016) and Helen Storey's Catalytic clothing, used for air purification (Storey and Ryan 2016). In an interview with Forbes magazine, Rebecca Pales-Friedman, a professor at Pratt Institute and author on smart textiles and wearable technologies, said: 'what makes smart fabrics revolutionary is that they have the ability to do many things that traditional fabrics cannot, including

communicate, transform, conduct energy and even grow' (Gaddis 2014). An example of this is Studio Roosegaarde's Intimacy 2.0 Dress which is made from leather and 'smart e-foils'. The transparency of the garment is controlled by the wearers' heartbeat; this high-tech approach has allowed the garment to become part of the body by listening and responding to internal functions (Roosengarde 2011). Roosengarde's Intimacy 2.0 Dress and on body robots such as Adam Whiton's ZipperBot that zips up your coat and Kino 'a kinetic accessory system which enables both aesthetic and functional clothing-specific design possibilities' (Kao 2017) are blurring the line between computer and man, creating cyborg like wearables. Cyborg activist Neil Harbisson's antenna allows him to 'listen to colour'; this antenna is arguably a wearable, but when does wearing a device make us a cyborg (Harbisson 2012)? On body devices are becoming part of our day to day lives and extend how we define our identity, for example Tien Pham's colour-changing LED temporary eyelashes *F.Lashes* allow us to make a fashion statement through wearable fast fashion technology (Pham 2017). Hsin-Liu (Cindy) Kao, currently a PhD student at Massachusetts Institute of Technology (MIT) Media Lab looking at *Hybrid Body Craft* states in a paper about one of her projects NailO 'In ways, people have started to view on-body devices as extensions of self' (Kao 2015). NailO and Duoskin developed by Kao et al (2016) at MIT Media Lab use the existing trend of temporary beauty enhancements through tattoos and nail art to truly integrate technology, decoration and function with the body.

The making of textiles is deeply rooted within our history and sense of identity; a quilt can contain many memories and act as a protective layer both mentally and physically (Gordon 2011). We use textiles for protecting our bodies, helping keep us warm or stay cool in different environments, and our clothing and fabric already connect with our feelings and outlook on life. Hajo Adam and Adam D. Galinsky (2012) call this 'enclothed cognition' the systematic influence that clothes have on the wearer's psychological processes, memory, decision-making and emotion.

## Textiles and Sound

This study focuses on how textiles, technology, design and sound can come together to create sensory experiences, applied within health and wellbeing. Alyce Santoro's work is an example of textiles enhanced using sound, her project Sonic Fabric is made from woven audio cassette tape that produces sound when a tape head is run over the material (Santoro 2003).

A talk during the London Design Festival in 2012 hosted by Wired Magazine and Be Open highlighted five different approaches to sound design. The most interesting of these was the question 'how we can make the world sound better?' Speaking at this event, Matthew Herbert suggested 'if every car engine produced a sound in the note of G, daily commutes could be a lot kinder on our hearing' (Herbert 2012). Valerie Trent writes 'designing the sound one hears is as important as the sounds you don't' (Trent, 2011), suggesting that in the past, designers have worked on how to block out the sound from their designs but are now instead looking at how to enhance it. The idea that sound does not have to be intrusive – making our world sound better could be important in the future of design for our general wellbeing and happiness.

## Approach

This PhD's research through practice looks to create a series of experimental sonic textiles by exploring a range of traditional and contemporary textile design techniques integrated with conductive materials and electronics.

By documenting the making of sonic textiles, this research hopes to encourage others to combine traditional textile making methods with the incorporation of sound. Kits will be created for designers and makers to build their own sonic textiles allowing the process of working with textiles, electronics and sound to be captured and shared through making.

Within the context of health and wellbeing, sonic textile prototypes will be tested in parallel with co-design workshops, ethnography, and action research. These research methods will highlight the need for design solutions, provide a deeper understanding of problems to be addressed, evaluate the findings of prototypes through engagement with society, and refine the making of sonic textiles. This iterative design process will continue throughout the study.

## The making of sonic textiles

Ongoing initial experiments working with conductive material, using the Bare Conductive Touch Board and the Ototo board, have allowed an initial three themes within sonic textile design to be explored: *Language, Maps and Traditional Conductive Materials*.

*Language*: Through research into identity, language was identified as a major factor in defining who we are; what language/s you speak, what accent you have, how you interpret language and what slang or local words you use. Bonnie Norton wrote in her chapter *Language and Identity* in the book **Sociolinguistics and Language Education** 'Everytime we speak, we are negotiating and renegotiating our sense of self in relation to the larger social world and recognizing that relationship across time and space' (Norton 2010). How we represent ourselves to the world can be shaped by the language we use or don't use. A collection of 'BRAW' (Figure 1) prototypes looks at how language, spelling and letters of the alphabet can be expressed through textiles is in development. Using conductive ink on paper 'Braw' (a Scottish slang word meaning fine or excellent (Oxford Dictionary 2017)) was written, when each letter is touched the Bare Conductive Touch Board speaks the letter. 3D textile letters were then made into sensors using conductive ink on fabric allowing the user to physically pick up and squeeze the letter to trigger the sound. This could be used to teach language, recognize different dialect and regional identities, remember words or read with the assistance of sound.

*Maps*: This theme was identified through taking part at Dundee Gov Jam 2017, where methods such as service design, journey mapping and interviews were used to understand how Dundee sounds to the people who live there. The group focusing on noise concentrated on the idea of crowdsourcing sounds from around Dundee to collect sonic data that affects the health and wellbeing of the residents. This has resulted in the concept of making a visual soundscape in conductive textiles to pair with city sounds, recreating the experience of being in a specific place or space within Dundee (Figure 2).

*Conductive Traditional Material*: Inspired by textile traditions and history, conventional textile techniques such as knitting, weave, printing and dry felting have been combined with conductive materials such as fibres, fabrics and inks to create *Conductive Traditional Materials*. These textiles, when connected to the Bare Conductive touch board or Ototo board, become sensors to create sound (**Figure 3**).

## Significance/ Application

This PhD will focus on how sonic textiles could be used to enhance health and wellbeing. The New Economics Foundation (NEF) has highlighted 'Health' and 'Wellbeing' as two of the indicators of national success alongside 'Good Jobs', 'Environment', and 'Fairness'. The awareness of the impact wellbeing has on our general health has grown within our living, working and learning environments. According to the NEF 2015 report 'The last decade has seen a resurgence of interest in the idea that policy should be focused on wellbeing, based on a comprehensive academic evidence-base showing that it is possible to measure wellbeing in a robust way, and that the results are highly relevant to a large number of policy areas.' (**Jeffrey and Michaelson 2015**) NEF's *Five Ways to Wellbeing* document highlights the cumulative organisations with a wellbeing approach, such as Action for Happiness, Happy City, and the Network of Wellbeing; and the adoption of wellbeing frameworks such as NEF's Five Ways to Wellbeing (**Aked et al. 2008**).

This study is currently considering health and wellbeing of those living with dementia, and/or, a sensory impairment, and their carers. There are 850,000 people with dementia in the UK (**Green 2017**). By 2026, 1 million people will be living with dementia, and the total UK annual spending on dementia care is projected to reach £35 billion (**Kings Fund 2012**). This rapid increase in numbers living with dementia will, in turn, have a significant impact on individuals, families and society (**Tredaway et al 2015**). Concerning sensory impairments, in the UK, more than eleven million people have some form of hearing loss (**Action On Hearing Loss 2015**) and over two million are living with sight loss (**RNIB 2014**). Sensory loss and dementia conditions present both a challenge and an opportunity for designers who hope to enhance health and wellbeing through their practice particularly as the UK is facing a rapidly ageing population.

## Textiles and design for Dementia

Textiles have been used as a vehicle to understand dementia and tell the story of those diagnosed with the disease. Lucy Stride from Falmouth University's project 'Dorothy's Dementia Diary' illustrates moments of her grandmother's behaviour and how dementia affected her family (**Craftivist Collective 2016**). The use of sonic textiles to tell people's stories could be used to help raise awareness of dementia and the effect it has on families, for example 2017 graduate of textile design at DJCAD, Mairi- Claire MacDonald's project 'Materialising Memories' captures her Grandpa's stories and memories. By using cushions printed with conductive ink touch sensors, she brings together imagery of Dundee with sounds of the streets, people and traffic allowing the public to experience her Grandpa's memories through sound (**Robertson 2017**). Through the stories and memories of those living with dementia, Cathy Treadaway used the Bare Conductive Touch Board in her work to create personalised sensory textiles incorporating sound, touch and haptics which stimulated

the recall of their memory (**Treadaway 2016**). This type of project starts to engage the public in thinking about dementia and the possible impact it has on wider society. Through this PhD, sonic textiles could act as an interface for public engagement in the area of dementia.

### **Textiles and design for sensory impairment**

Wearables can aid our sensory experience of the world and provide a sense of independence for the wearer. Researchers Bahadir, Koncar, and Kalaoglu developed a 'Smart shirt for obstacle avoidance for visually impaired persons' using sensors and textiles to create a tactile solution allowing the user to move around independently without bumping into hazards.

(**Bahadir, Koncar, and Kalaoglu 2016**). Another example 'Sound Shirt' by Cute Circuit (**Mayer 2016**) helps those hard of hearing, enabling them to 'hear' an orchestra through vibration and light incorporated in the shirt. The addition of sound to traditional textiles could enhance the user's understanding of the world through their senses.

### **What's next?**

Through practice the initial making and prototyping of sonic textiles will be continued, building on current themes of language, maps and conductive traditional materials.

Interviews will be planned, participants recruited and ethics put in place. After interviews, focus groups will then be formed and prototypes tested by participants. The outcomes of these initial workshops will shape the future of the study. As the research progresses the outline is likely to change to reflect new knowledge and learning gained. Further reading is required in the areas of e-textiles, textiles for dementia, textiles for sensory impairment, and design for health and wellbeing.

### **Closing notes**

This paper has outlined a current PhD study where contemporary and traditional textile techniques with conductive materials and technology are combined to make sonic textiles for health and wellbeing. Through practice and the creation of a sonic textiles kit, this study will engage and collaborate with designers and makers. Alongside the creation of sonic textiles, this PhD is looking to explore identity through making and the influence making has on the individual's sense of self. Using a variety of methodologies such as making, active research, ethnography and co-design, this study will recruit participants to gain a deeper understanding of people's experience within health and wellbeing while testing and evaluating the success of sonic textiles.

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### **Figures**

**Figure 1.** BRAW printed in conductive ink attached to the Bare Conductive Touch Board.

**Figure 2.** Map of Dundee Soundscape concept attached to Ototo Board.

**Figure 3.** Woven, knitted and crochet samples integrated with conductive materials to create sensors.

## References

- Action on hearing loss. 2017. 'Statistics'. June 16. <https://www.actiononhearingloss.org.uk/your-hearing/about-deafness-and-hearing-loss/statistics.aspx>.
- Adam, Hajo, and Adam D Galinsky. 2012. 'Enclothed Cognition'. *Journal of Experimental Social Psychology* 48 (4): 918–25.
- Aked, Jody, Nic Marks, Corrina Cordon, and Sam Thompson. 2008. 'Five Ways to Wellbeing'. The new economics foundation. [http://b3cdn.net/nefoundation/8984c5089d5c2285ee\\_t4m6bhqq5.pdf](http://b3cdn.net/nefoundation/8984c5089d5c2285ee_t4m6bhqq5.pdf).
- Bahadir, S. K., V. Koncar, and F. Kalaoglu. 2016. '3 - Smart Shirt for Obstacle Avoidance for Visually Impaired Persons'. *Smart Textiles and Their Applications*, 33–70. doi:<https://doi.org/10.1016/B978-0-08-100574-3.00003-5>.
- 'Braw - Definition of Braw in English | Oxford Dictionaries'. 2017. *Oxford Dictionaries | English*. Accessed June 16. <https://en.oxforddictionaries.com/definition/braw>.
- 'CUTECIRCUIT'. 2017. *CUTECIRCUIT*. June 16. <https://cutecircuit.com/>.
- Duval, S., and H. Hashizume. 2005. 'Cyberclothes: Personal Media in Everyday Life'. In *Proceedings of the 2005 International Conference on Active Media Technology, 2005. (AMT 2005)*, 44–47. doi:10.1109/AMT.2005.1505263.
- 'Five Headline Indicators of National Success'. 2017. Accessed June 20. <http://neweconomics.org/2015/10/five-headline-indicators-of-national-success/>.
- Gaddis, Rebecca. 2014. 'What Is The Future Of Fabric? These Smart Textiles Will Blow Your Mind'. *Forbes*. May 7. <http://www.forbes.com/sites/forbesstylefile/2014/05/07/what-is-the-future-of-fabric-these-smart-textiles-will-blow-your-mind/>.
- Gordon, Beverly. 2011. *Textiles - The Whole Story*. London: Thames & Hudson.
- Green, Kathryn. 2017. 'Facts for the Media'. *Alzheimer's Society*. June 15. [https://www.alzheimers.org.uk/info/20027/news\\_and\\_media/541/facts\\_for\\_the\\_media](https://www.alzheimers.org.uk/info/20027/news_and_media/541/facts_for_the_media).
- Harbisson, Neil. 2012. *I Listen to Color*. [https://www.ted.com/talks/neil\\_harbisson\\_i\\_listen\\_to\\_color](https://www.ted.com/talks/neil_harbisson_i_listen_to_color).
- Herbert, Mathew. 2012. 'BE OPEN Sound Design Talk with WIRED Magazine'.
- Hsin-Lui, (cindy) Kao, Deborah Ajilo, Oksana Anilionyte, Artem Dementyev, Inrak Choi, Sean Follmer, and Chris Schmandt. 2017. 'Exploring Interactions and Perceptions of Kinetic Wearables'. *DIS '17 Proceedings of the 2017 Conference on Designing Interactive Systems*, June, 391–96. doi:10.1145/3064663.3064686.
- Imison, Candace. 2012. 'Kings Trust Future Trends: An Overview'. [https://www.kingsfund.org.uk/sites/files/kf/field/field\\_publication\\_summary/future-trends-overview.pdf](https://www.kingsfund.org.uk/sites/files/kf/field/field_publication_summary/future-trends-overview.pdf).
- Jeffrey, Karen, and Juliet Michaelson. 2015. 'Five Headline Indicators of National Success A Clearer Picture of How the UK Is Performing'. The new economics foundation. [http://b3cdn.net/nefoundation/1ff58cfc7d3f4b3fad\\_o4m6ynyiz.pdf](http://b3cdn.net/nefoundation/1ff58cfc7d3f4b3fad_o4m6ynyiz.pdf).
- Kao, Hsin-Liu (Cindy). 2016. 'DuoSkin: Rapidly Prototyping On-Skin User Interfaces Using Skin-Friendly Materials'. *Cindy Hsin-Liu Kao*. <http://cindykao.com>.



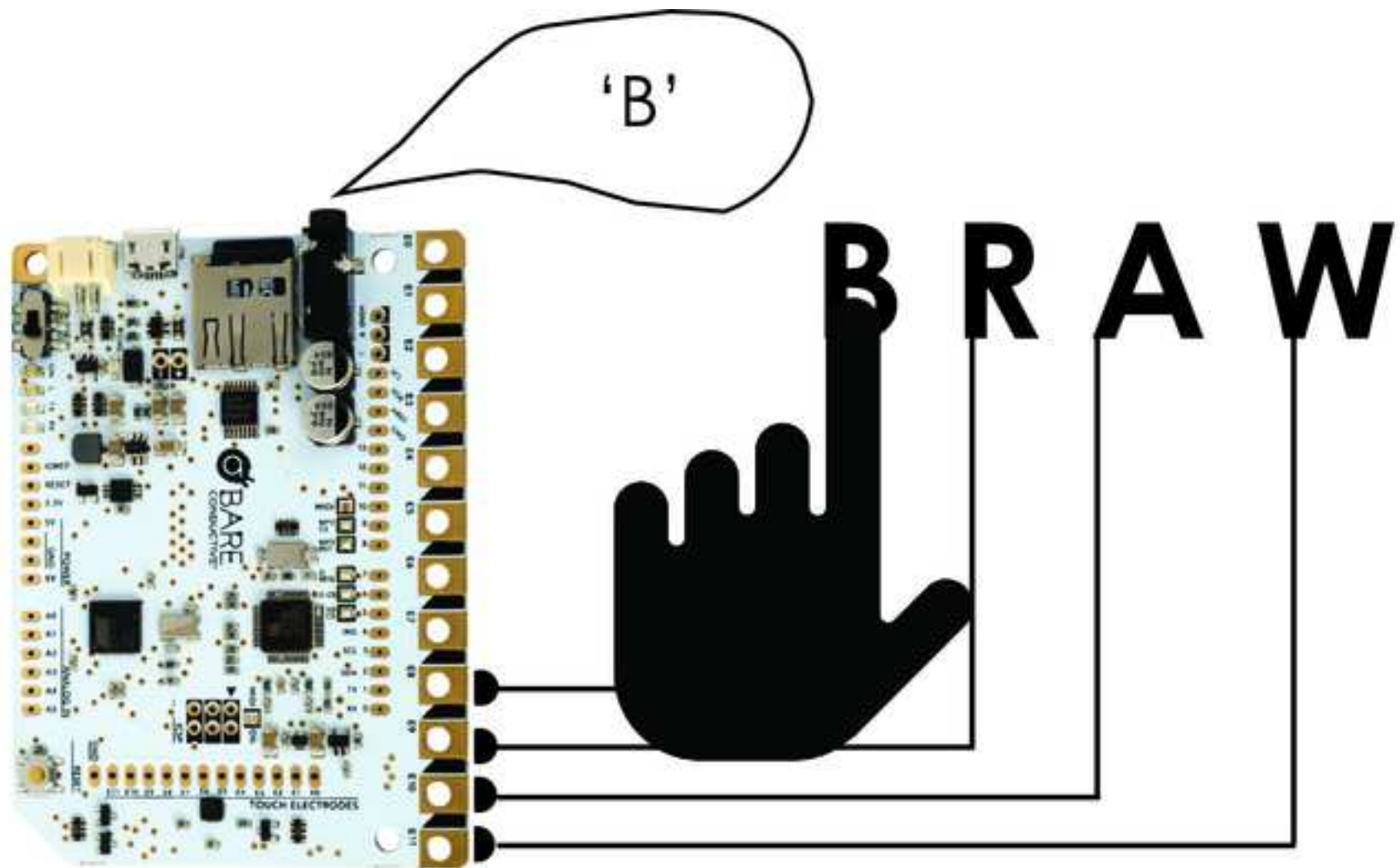
- Kao, Hsin-Liu (Cindy), Artem Dementyev, Joseph A. Paradiso, and Chris Schmandt. 2015. 'NailO: Fingernails as an Input Surface'. *CHI '15 Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, April, 3015–18. doi:10.1145/2702123.2702572.
- Lipsky, Jessica. 2014. 'Wearables Sing in Smart Clothes | EE Times'. July 28. [http://www.eetimes.com/document.asp?doc\\_id=1323257](http://www.eetimes.com/document.asp?doc_id=1323257).
- 'Lucy's Craftivist Project "Dorothy's Dementia Diary"'. 2016. *Craftivist Collective*. May 18. <https://craftivist-collective.com/Dorothys-Dementia-Diary>.
- Meyer, David. 2016. 'This Shirt Can Help Deaf People Feel Music'. *Fortune*. May 18. <http://fortune.com/2016/05/18/cutecircuit-sound-shirt/>.
- Norton, Bonnie. 2010. 'Language and Identity'. In *Sociolinguistics and Language Education*, 349–69.
- O'Mahony, Marie. 2011. *Advance Textiles for Health and Wellbeing*. Thames & Hudson.
- Pham, Tiem. 2017. 'F.lashes - Fun Interactive LED Eyelashes - Home'. Accessed June 20. <https://www.facebook.com/lashesLEDlashes/>.
- RNIB. 2014. 'How Many People in the UK Have Sight Loss? - RNIB - Supporting Blind and Partially Sighted People'. June 15. <https://help.rnib.org.uk/help/newly-diagnosed-registration/registering-sight-loss/statistics>.
- Robertson, Lucy. 2017. 'Mairi- Claire MacDonald – Materialising Memories'. *Lucy Robertson Designs*. May 31. <https://lucyrobertsondesigns.wordpress.com/2017/05/31/mairi-claire-macdonald-materialising-memories/>.
- Roosegaard. 2011. 'Studio Roosegaard — Intimacy 2.0'. <https://www.studioroosegaard.net/project/intimacy-2-0/>.
- Santoro, (Alyce. 2003. 'Sonic Fabric - Woven from Sound'. *Sonic Fabric*. <http://www.sonicfabric.com/>.
- Storey, Helen, and Tony Ryan. 2016. 'Catalytic Clothing'. <http://www.catalytic-clothing.org/>.
- Treadaway, Cathy. 2016. 'How Designing Smarter Textile Tech Can Help People Living with Dementia'. *The Conversation*. May 20. <http://theconversation.com/how-designing-smarter-textile-tech-can-help-people-living-with-dementia-59503>.
- Treadaway, Cathy, David Prytherch, Gail Kenning, and Jac Fennell. 2016. 'In the Moment: Designing for Late Stage Dementia'. *Proceedings of DRS 2016, Design Research Society 50th Anniversary Conference. Brighton, UK, 27–30 June 2016*.
- Trent, Valerie, and 2011. 2011. 'What If We Designed With All 5 Senses?' *Work Design Magazine*. February 2. <https://workdesign.com/2011/02/what-if-we-designed-with-all-5-senses/>.

## Biography

Lucy Robertson is a postgraduate researcher with a background in textile design, marketing and entrepreneurship. She is currently undertaking a PhD to explore sonic textiles for health and wellbeing. Her research interests lie in e-textiles, craft, entrepreneurship, marketing and education.

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Bare Conductive Touch Board

Figure 2

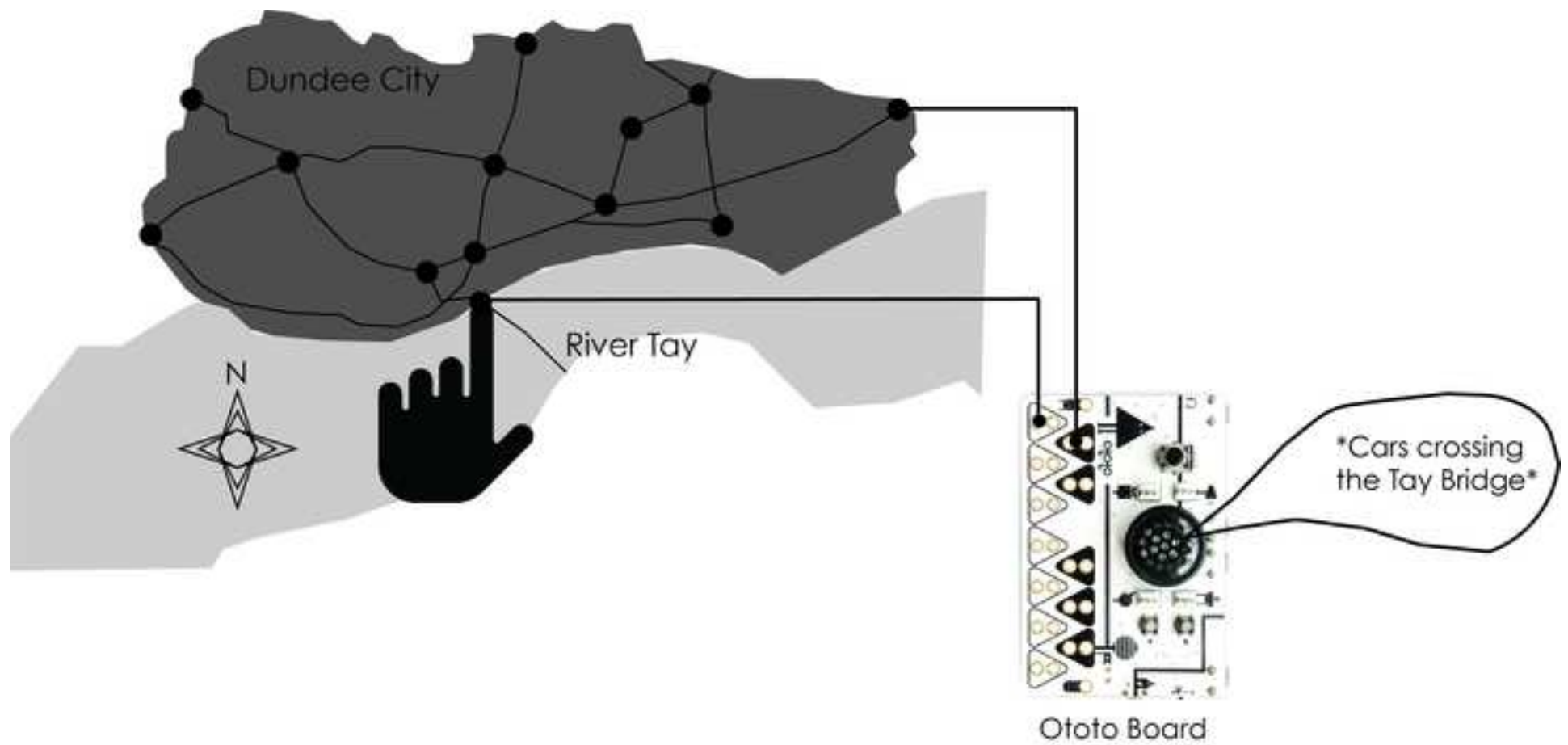


Figure 3

[Click here to download Figure Figure 3.jpg](#)

